

Water Quality

With more than 10,000 lakes, 100,000 miles of river and streams, and about 9.3 million acres of wetland, water is a major part of Minnesota's culture, economy and natural ecosystems. Policies in the 1970s resulted in cleaner water than ever before, but in the last 30 years water quality has declined overall. While local government and industrial sites have taken steps to improve water quality, managing pollution from chemical runoff will continue to be a challenge. Transportation infrastructure and adjacent land development stress water quality by generating pollutants and disrupting the natural filtration system. Finding ways to limit these impacts is important to improving Minnesota's water quality.

WATER QUALITY IN MINNESOTA

Water quality in Minnesota's lakes, rivers, groundwater, wetlands, and watersheds is impacted by humans and natural sources. A recent Minnesota Pollution Control Agency study¹ found that current programs and strategies are not improving water quality in the state. The data shows that phosphorus and nitrogen, high bacteria levels and mercury contamination continue to be problems in many of Minnesota's lakes, rivers and streams. These pollutants, which are typically the product of urban and agricultural land runoff, have left many bodies of water unfit for human consumption and aquatic life. Despite the state's abundance of lakes, rivers, groundwater and streams, more than 40 percent of Minnesota's waters are currently listed as impaired or polluted.² Comprehensive water management strategies will be important to improve water quality in the future.

Phosphorus, Nitrogen and Bacteria

Several pollutants can harm water quality. Phosphorus from wastewater and agricultural activities can create algae blooms that are harmful to aquatic life and human recreation.³ Bacteria from untreated human and animal waste, nitrate from agricultural activities, and sediment from natural or human activities all have similar harmful impacts on water quality. These pollutants all spread out in fresh water quicker and in more abundance when water washes them off roads. When runoff goes directly into ditches and streams it doesn't go through a natural filtration process to remove these pollutants. This can then pollute watersheds – areas where all water in a region collects and drains to the same location.⁴

Chloride

Chloride is another pollutant that can cause poor water quality in lakes and rivers. Once chloride gets into a water source it is very difficult and impractical to remove. Since chloride is easily spread and does not biodegrade, it has long lasting effects on soil, vegetation, water and air. Long-term chloride build up in soil can reduce the fertility of the land and cause drought-like conditions including stunted growth, brown leaves and premature plant growth.⁵ Groundwater in Minnesota is polluted with chloride from deicing salts. Twenty-seven percent of groundwater aquifers in urban areas in Minnesota are worse than statewide standards set for chloride levels.⁶ The impact is also seen in surface waters where a small amount of salt can harm aquatic life. One teaspoon of salt can pollute five gallons of fresh water to a point where chloride can become toxic to fish, plants and insects.⁷ The MPCA found that 47 bodies of water were impaired due to chloride pollution in 2016 which increased from four

¹ [Minnesota Pollution Control Agency \(MPCA\) Watershed Achievements Report 2015](#)

² [Minnesota Pollution Control Agency \(MPCA\) Watershed Achievements Report 2015](#)

³ [MPCA Our upper Mississippi River](#)

⁴ [USGS Water Science School](#)

⁵ [MPCA Minnesota Stormwater Manual](#)

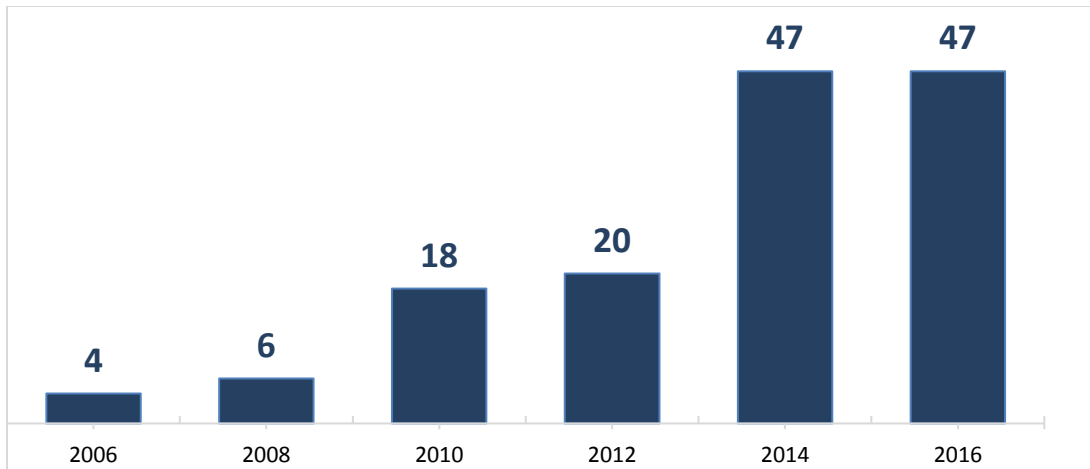
⁶ [MPCA Minnesota Stormwater Manual](#)

⁷ [MPR 2017](#)

bodies of water in 2004.⁸ Although the harm is significant to the environment, current levels of chloride are not believed to be very toxic to humans. However, high concentrations give water a salty taste.⁹

There are two major sources of chloride pollution today. The first is from salt that runs off of impervious surfaces like roads and into nearby fresh water. Salt is used to make roads safe for travel during the winter and once the snow melts, salt then washes into nearby lakes, wetlands and groundwater.¹⁰ Another major source of salt is from water softeners in homes and businesses. Many wastewater treatment facilities are not designed to clean the necessary amount of salt from water.

Figure 1: Number of bodies of water impaired by chloride in MN



CURRENT ROAD SALT USE

MnDOT is the single largest user of road salt in Minnesota, and has applied approximately 150,000 to 300,000 tons annually to state roads throughout Minnesota over the past 10 years (see Figure 2). Many other entities in addition to MnDOT use salts to aid in their winter maintenance efforts, including county and city road authorities, private snow-clearing companies, individual homeowners and others.

Salt is used on state highways to make roads safer to travel on during the winter. Salt can be used for different strategies to keep roads safe. Depending on the temperature and road condition, salt can be used to prevent snow and ice from bonding to pavement, to breakup ice and snow pack, and to melt black ice that has formed on roadways.¹¹

The amount of salt used is highly dependent on weather. More snow and ice requires more salt to increase travel safety. (Figure 2). MnDOT is trying to reduce its salt use and has had some success. Winter of 2015 showed a decrease in salt and sand use even though winter severity increased. Only about 30 percent of the road salt applied in the Twin Cities Metro Area is carried away and dissolved in the Mississippi River. Seventy percent is unaccounted for, potentially staying in Minnesota groundwater, lakes or wetlands.

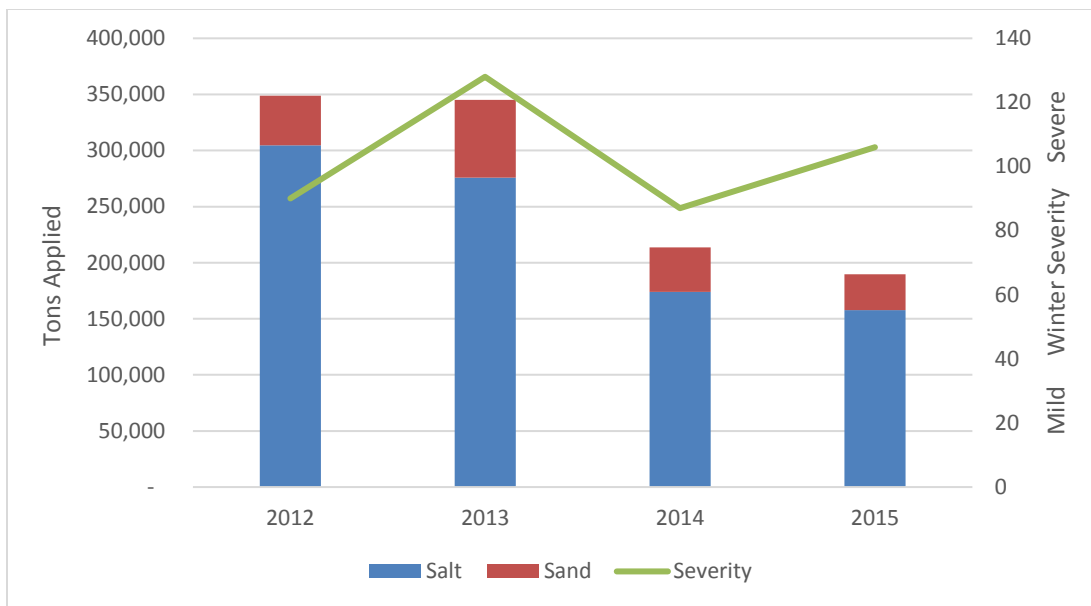
⁸ [MPCA Minnesota's Impaired Waters List](#)

⁹ [MPCA Groundwater Protection Recommendations Report](#)

¹⁰ [MCPA](#)

¹¹ [MnDOT](#)

Figure 2: MnDOT Salt and Sand Usage Compared to Winter Severity



The following strategies are used to reduce the amount of salt used on roads during the winter.

MANAGEMENT STRATEGIES

- New technology to optimize the treatment and use of salt on roads
- Liquid chemical deicers use instead of salt or sand
- Underbody plows to reduce the amount of salt needed
- Driver training to teach new snow plowing techniques
- Pursuit of chemical and equipment innovations not currently used at MnDOT

SNOW FENCES

Landowners near highways can help limit the amount of snow plowing and salt used on state highways. Living snow fences are used across Minnesota to limit the amount of snow that drifts onto a highway, especially in Greater Minnesota (Figure 3). Living snow fences are trees, shrubs, native grasses and wildflowers located on roadsides. Farmers also leave corn rows and hay bales near roads to control blowing snow. There are many benefits to these barriers including safer roads, financial savings, improved crop yields, improved pollinator habitat and less salt use. MnDOT's living snow fence program provides funding opportunities for land owners. This program has resulted in 70 miles of living snow fence and 17 miles of standing corn rows. The miles of standing corn rows has doubled since 2011 and should continue to grow in the future. If the opportunity for a living snow fence isn't available, some landowners have chosen to construct a structural snow fence with wood and metal posts.

Figure 3: Photo of Living Snow Fence



STORMWATER

When rain or snow falls onto the ground it is considered stormwater. Stormwater can contain harmful chemicals like lead, cleaning solvents, chloride, phosphorus, pesticides, bacteria and viruses. One of the best ways to improve water quality in the state is to improve stormwater management.¹² Stormwater has long been seen as a risk to transportation infrastructure and nearby properties. Environmental issues related to stormwater are becoming more important, especially in terms of pollutant control and infiltration. Stormwater collects around impervious surfaces like roads, parking lots and building rooftops. It can become contaminated and eventually flow into nearby lakes and streams without being properly treated. When water collects on road surfaces it can be contaminated by pollutants from vehicles, deicing materials or other chemicals from surrounding land uses like agriculture, yard fertilizers or pet waste. Urban areas have a large percentage of impervious surfaces that cause faster and larger quantities of water runoff to flow into our watersheds with higher quantities of pollutants. The Metropolitan Council found that creeks where surrounding land use had a higher percentage of impervious surface also had poorer water quality.

There are a few general strategies to minimize negative impacts of stormwater:

- Control the flow of stormwater to reduce flooding
- Treat runoff before it reaches nearby lakes
- Reduce the materials available to enter the flowing stormwater

Conventional stormwater management detains water in ponds and constructed wetlands to control release rates and to prevent sediment from reaching freshwater lakes and rivers. These controls also help to prevent major flood risks from large rain events. Other low-impact development ideas to control stormwater include green roofs, bioswales or rain gardens, curb cuts, catch basins, porous pavements and tree planting.

¹² [MPCA](#)

WETLAND LOSS

Wetlands provide important ecological services, including wildlife habitat, water filtration and recycling, water quality protection, and stormwater management. A wetland is defined as the land that is a transition from aquatic habitat to upland. These can take the form of bogs, marshes, shallow open water, swamps, wet meadows or seasonally flooded wetlands. Wetland water levels are less than seven feet deep and some can be dry for much of the year. The wetlands in Minnesota were affected by land development and human impact for decades leading to the loss of half of the original wetland acreage in the state¹³. This loss of wetlands increased the risk of flooding around impervious surfaces like roads because of the ability of wetlands to retain and slow runoff.

While transportation projects are not a major source of wetland loss in Minnesota, MnDOT is required to replace wetlands at an average of 1.5 acres for each acre impacted.

The Minnesota Wetland Conservation Act in 1991 requires entities to:

- Achieve no net loss in the quantity, quality and biological diversity of Minnesota's existing wetlands
- Increase the quantity, quality and biological diversity of Minnesota's wetlands by restoring or enhancing degraded or drained wetlands

This legislation slowed the dramatic draining of wetlands. Minnesota's wetlands are balanced in quantity, but the quality of wetlands that are created in substitution is poor. Results from a study done by the Minnesota Department of Natural Resources from 2006 to 2011 show that wetlands that were drained were replaced with the same amount of wetlands, but these wetlands were cultivated and don't have the same characteristics of native wetlands.¹⁴ Despite significant public investment, incentive based programs to reduce the drainage of wetlands did not increase wetland acres exponentially and resulted in wetlands lacking important vegetation. Much of the new wetlands are pond-like and lack characteristics important to wildlife.¹⁵ Research shows that of the wetlands gained in Minnesota, 67 percent are classified as ponds. While they were established to replace permanent wetlands, many of these ponds are temporary.¹⁶ Wetlands need to be restored to their native setting in order to perform essential ecological services.

RELATED TRENDS

- Biodiversity
- Climate Change
- Health Trends in Minnesota
- Racial Disparities and Equity in Minnesota

¹³ [Minnesota Department of Natural Resources](#)

¹⁴ Status and Trends of Wetlands in Minnesota: Wetland Quantity Trends from 2006-2011

¹⁵ Status and Trends of Wetlands in Minnesota: Wetland Quantity Trends from 2006-2011

¹⁶ Status and Trends of Wetlands in Minnesota: Wetland Quantity Trends from 2006-2011